with that active component within an antenna element radiating aperture having a largest dimension of about one half wavelength at the lowest frequency of its operational bandwidth (i.e., a "small" antenna element). Claim 1 also requires a controllable variable reactance load connected to at least one parasitic component of each of the plural small antenna elements that are distributed over the array aperture -- and an array controller connected to control at least the variable reactance loads thereby to control, at least in part, a predetermined characteristic of the array.

The Examiner relies upon Figure 7 of Gothard and associated text. Figure 7 shows a single active antenna element 706 surrounded by five parasitic antenna elements 701-705. Each of the parasitic antenna elements 701-705 is associated with a respective adjustable impedance component 711-715 which is controlled by a laptop computer 150 and impedance control input lines 730 connected between the laptop 150 and the adjustable impedance components 711-715.

The active element 706 and the parasitic elements 701-705 are all located on a circular housing 710. So far as the undersigned can ascertain, the only teaching of spacing between the central active element 706 and the circumferentially arranged parasitic elements 701-705 is found at column 12, lines 13 et seq.:

> "...The distance between each passive antenna elements 701 through 705 and the active antenna element 706 is great enough so that the phase relationship between a signal received by more than one element 701 through 706 will be somewhat out of phase with other elements that also receive the same signal, assuming the passive antenna elements 701 through 706 have the same impedance setting, which

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> translates into phase setting, as determined by adjustable impedance components 711-715. That is, if the phase setting of each element 701 through 705 were the same, each element 701 through 705 would receive the signal somewhat out of phase with the other elements."

Presumably, the Examiner is considering the active element 706 and its surrounding parasitic elements 701-705 to constitute a <u>single</u> instance of applicant's claimed "small antenna elements". If so, then where is there any teaching or suggestion that all of the active and parasitic components of that single instance of a small antenna element be within the required small antenna element radiating aperture having a largest dimension of about one half wavelength at the lowest frequency at its operational bandwidth? Applicant requires each of the small antenna elements comprising the over arching larger array aperture to be self-contained within this relatively small dimension -- in part because a plurality of these individual small plural component antenna "elements" have to be spatially distributed over the array aperture with each of the multi-component small antenna elements itself providing only a relatively small radiating aperture (i.e., so as to constitute one effectively controlled element of the overall array aperture).

Even where Gothard briefly suggests the possibility of having more than one active antenna element 706 located on platform or housing 710, there is no indication that a plurality of such multi-component assemblages (i.e., of one or more active element 706 and its associated parasitic elements 701-705) would be replicated across a larger array aperture. Indeed, to the contrary, Gothard merely notes that if the embodiment of Figure 7 is to be modified so as to have plural active antenna elements 706, then the composite

(multi-component) antenna apparatus 700 associated with the platform or housing 710 needs to include a suitable bi-directional summation network or splitter/combiner 120, a transceiver 130 and a control processor 140, which are all interconnected via a bus 135 (which the undersigned has been unable to find in either Figure 2 or Figure 7). See, for example, the discussion at column 11, at line 62 *et seq*. where the possibility of having multiple active antenna elements 706 is briefly mentioned.

In short, even if it is assumed *arguendo* that Figure 7 and the associated text of Gothard teaches a single instance of a small antenna element having both active and reactively-controlled parasitic components co-located on housing 710 with the variable reactance loads being controlled to determine a characteristic of that collection of active/parasitic components, there is still no teaching or suggestion in Gothard that such collection of active/parasitic components as revealed in Figure 7 could or should be employed as <u>one</u> of plural such small antenna "elements" disposed across a larger RF antenna array -- and controlled as individual elements of the array so as to counteract some of the otherwise unfortunate mutual coupling that occurs between elements of an overall phased array architecture.

As explained in applicant's specification, real world practical phased arrays are often compromised by, *inter alia*, undesirable mutual coupling between the controlled elements of the array. The applicants have recognized that if <u>each</u> of the <u>plural</u> elements of a controlled phased array is <u>itself</u> a small antenna element having at least one active component and at least one reactively-controlled parasitic component co-located with that

active component and the variable reactive loads to the parasitic elements are appropriately also controlled by the array controller (i.e., in addition to the normal RF magnitude/phase control of the array controller), then the overall array performance can be substantially improved. There simply is no such teaching or suggestion anywhere in Gothard.

The Examiner's discussion of Gothard's Figure 7 embodiment is also clearly erroneous in at least some respects. For example, the Examiner refers to Gothard's Figure 7 as being one wherein at least some of the plurality of antenna elements "each including at least one active component 711-715 and at least reactively controlled parasitic components 701-706". Actually, elements 711-715 are not active radiating components but, instead, adjustable impedance components respectively associated with the parasitic antenna elements 701-705. Furthermore, the controlled parasitic antenna elements comprise only elements 701-705. Antenna element 706 is the only active (i.e., fed) antenna element in the collection in elements shown in Figure 7.

The Examiner also refers to "an array controller 140, shown in Fig. 7, and connected to at least a variable reactance loads …". Actually, there is no array controller 140 shown in Figure 7. The box 140 shown in Figure 2 is described as a "control processor". Figure 2 shows control processor 140 as receiving its only input from transceiver 130. Furthermore, it is shown as controlling only the phase shifters 111 through 115 associated with active (i.e., fed) elements 101-105. In short, Figure 2 depicts only conventional RF magnitude/phase control to each of plural active elements. There is

no teaching of any array controller connected to control variable reactance loads associated with each of plural small antenna elements specially distributed over an entire array aperture, at least some plurality of such small antenna elements each including at least one active component and at least one reactively-controlled parasitic component co-located therewith (let alone being co-located therewith inside a very small individual small antenna element radiating aperture having a largest dimension of about one half wavelength at the lowest frequency of its operational bandwidth).

The Examiner also alleges that the Gothard "array can be selected in sub-arrays for providing directionality of the beam pattern by varying the phases in the parasitic elements using active components". Actually, the undersigned cannot find any teaching or suggestion in Gothard of treating the collection of active/parasitic components shown in Figure 7 as a sub-array.

The Examiner also alleges that a "skilled artisan would have found it obvious to provide the radiating aperture the size of the lowest resonance frequency of operation (one half wavelength)".

However, as noted above, that is not the teaching or suggestion of Gothard. Furthermore, as noted above, one of the reasons applicant has maintained the radiating aperture of each of the plural small antenna elements (each small antenna element comprising both active and parasitic components co-located therewithin) to be less than about one half wavelength at the lowest operational frequency is because each of such small aperture antenna elements is but one part of a larger RF antenna array architecture.

Applicant's claim 8 depends from independent method claim 5 and requires the parasitic components to be controlled by use of a feedback control sub-system that adjusts RF properties of the parasitic components based on an observed metric. Here, the Examiner alleges such to be taught in Gothard in the paragraph beginning at column 13, line 51. However, this section of Gothard involves adjustments made during a non-active "idle time period". It must also be read in conjunction with the entirety of the Gothard teaching which appears to require manual adjustments of the antenna assemblage (e.g., see block 1125 in Figure 11) rather than any feedback control sub-system that itself adjusts RF properties of the parasitic components based on an observed metric.

In the Examiner's "Response to Arguments" section, the Examiner states as follows:

> "The added language to the half wavelength at the lowest frequency is a well known relationship in order for the low frequencies to be useful in the antenna array. A skilled artisan would have found it obvious to employ such a dimension. Thus, the claims are not seemed to patentably define over the prior art of record."

Perhaps the undersigned does not fully understand the Examiner's intended comment. However, if it indeed is a "well known relationship" that the radiating aperture of each antenna element in an array must have a largest dimension of about one-half wavelength at the lowest frequency of its operational bandwidth, there would still be no teaching or suggestion that one should use for such an elemental radiating aperture within an over arching array architecture a small antenna element having both active and

parasitic components co-located within that about one-half wavelength dimension -- let alone to include in the over arching array a controller connected to control the variable reactance loads associated with the parasitic components of each of the small antenna elements having less than one-half wavelength dimension.

In any event, in accordance with standard USPTO practice, it is respectfully requested that the Examiner provide documented proof of the allegedly "well known relationship" apparently relied upon to reject applicant's current claims.

Although the above remarks have concentrated on applicant's independent apparatus claim 1, they are also believed to be applicable to applicant's independent method claims 3 and 5. In particular, method claim 5 requires co-locating a reactively-control parasitic component within an antenna element radiating aperture having a largest dimension of about one-half wavelength at the lowest frequency of its operational bandwidth of each of plural active small antenna components in a phased array. Claim 5 also requires controlling those parasitic components by changing the value of a reactance connected thereto to change operational characteristics of the corresponding co-located active antenna components.

Independent method claim 3 also requires arranging a plurality of small antenna elements spatially distributed over an array aperture as well as including in each of at least some plurality of the small antenna elements, both at least one active component and at least one reactively-controlled parasitic component co-located with that active component within a small (i.e., less than one-half wavelength at the lowest frequency)

radiating aperture. Method claim 3 also requires controlling changes in at least the variable reactance loads of the parasitic elements so as to control at least in part a predetermined characteristic of the overall array (i.e., of plural small antenna elements distributed over the entire array aperture).

It is noted that the Examiner has, in effect, only discussed applicant's claims 1 and 8.

It should be noted that applicant's dependent claim 2 further requires the array controller to also control the RF signals (e.g., magnitude/phase) being fed to/from the active components. While the control processor 140 shown in Figure 2 of Gothard presumably relates to such conventional phased array control *per se*, dependent claim 2 makes it clear that the array controller being recited in claim 1 controls things in addition to conventional magnitude/phase RF control. In particular, as already noted, claim 1 requires the array controller to control the variable reactance loads -- and claim 2 makes it clear that the array controller also must control the RF signals being fed to the active elements. That is, the context of dependent claim 2, the array controller controls both the active elements and the parasitic elements of each of the small antenna elements specially distributed over the entire array aperture.

Dependent claim 4 adds to the method of claim 3 by also requiring control of the RF signals being fed to and from the active components.

The Examiner's attention is directed to applicant's dependent claim 9. Here, applicant's claimed invention requires the parasitic components to be controlled so as to

effect changes in at least one of: directivity, frequency tuning, instantaneous bandwidth, polarization and radar cross section. While Gothard my be assumed *arguendo* to control parasitic components of a <u>single</u> collection of active/parasitic components disposed on housing 710 so as to control the directivity of that collection of components, Gothard does <u>not</u> teach an array of such assemblages of active/parasitic components wherein the parasitic components of each <u>element</u> of such an over arching array are controlled so as to control directivity of the over arching array. Nor, of course, does Gothard in any way teach or suggest controlling the parasitic components to effect changes in frequency tuning, instantaneous bandwidth, polarization or radar cross section.

Dependent claim 13 requires the array controller of claim 1 to be configured and connected so as to control the RF/electrical properties of the parasitic components as well as the phase of associated active antenna components so as to achieve control over at least an <u>array</u> beam pointing angle. That is, the beam pointing angle of the entire assemblage of small antenna elements distributed over the entire array aperture is controlled so as to control the beam pointing angle of that entire assemblage. As applicant has explained in the specification, this control of reactance in each individual array element (i.e., within each small antenna radiating aperture within the array) permits one to effectively compensate for at least some of the adverse mutual coupling effects otherwise experienced to the detriment of the beam pointing angle of the entire array assemblage of elements.

Claim 14 depends from claim 3 but is otherwise similar to claim 13 and comments just made apply to claim 14 as well.

Similarly, claim 15 depends from independent method claim 5 but is otherwise similar to claims 13 and 14 and comments just made apply to that as well.

Dependent claim 16 requires the array controller to include a digital beam former circuit from which information is extracted to at least assist in control of the parasitic components of each multi-component "element" of the array. The Examiner has not even alleged such to be found anywhere in Gothard. Claim 17 requires the digital beam former circuit to also provide phase control for the active antenna components of each such multi-component "element". Where is there any such teaching in Gothard? The Examiner has not even alleged such.

Claims 18-19 depend ultimately from claim 3 but are otherwise similar to claims 16 and 17 and the above noted comments apply equally here as well.

Similarly, claims 20 and 21 depend ultimately from independent method claim 5 but are otherwise similar to claims 16 and 17 and the above comments also apply here as well.

Claims 22 and 23 depend respectively from independent apparatus claim 1 and independent method claim 3. They both require that sub-sets of the small antenna elements be connected for common control -- thus to form respective sub-arrays.

Although Figure 7 does show a single laptop computer 150 as controlling the active and parasitic components depicted in Figure 7, even if that was considered to be a

single instance of a small multi-component antenna element, there is no teaching or suggestion of a plurality of such small multi-component antenna elements being arrayed in a larger aperture nor of any sub-sets of such a larger plurality being divided into groupings for individual common control -- thus to form a respective sub-array of the larger array.

Accordingly, this entire application is believed to be in allowable condition and a formal Notice to that effect is respectfully solicited.

Respectfully submitted,

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